

PAPER DISCHARGE UNIT AND PRINTING APPARATUS EMPLOYING THE PAPER  
DISCHARGE UNIT

BACKGROUND OF THE INVENTION

5                   Field of the Invention

The present invention relates to a paper discharge unit for discharging papers on which images, for example, have been printed by a plurality of printing engines. The present invention also relates to a printing apparatus that employs the  
10 paper discharge unit.

Description of the Related Art

Recently, printing services, wherein images which have been photographed with digital cameras are printed, are being provided, along with the spread of digital cameras. As a manner  
15 in which these printing services are provided, there is known a printing apparatus provided with a plurality of printing engines, each housing paper therein (refer to Japanese Unexamined Patent Publication No. 2001-162871). The printing apparatus is configured to receive a recording medium such as  
20 a SmartMedia™ having image data recorded therein, and to print images represented by the image data with the plurality of printing engines within the apparatus. By providing a plurality of printing engines, image data can be printed in parallel. Thus, high speed, efficient printing processes are  
25 enabled.

Various types of paper sizes exist for the paper on which

images are printed. Examples include: postcard size, 3x5, 4x6, and CD size. Each printing engine performs printing on papers of a plurality of paper sizes. A discharge mechanism capable of discharging the largest print size is provided, in order to  
5 enable discharge of all of the print sizes.

The discharge mechanism is constituted by a chute box, which guides the papers output by the print engines to an ejection opening. For example, the chute box of a printing apparatus, which prints onto papers of the postcard size, 3x5,  
10 4x6, and the CD size, is capable of discharging papers of the 4x6 size, and has a width so that the 4x6 size papers do not rotate therein.

However, when papers smaller than the 4x6 size move through the chute box gaps exist between the chute box and the  
15 papers. Therefore, the papers rotate within the discharge mechanism. When the papers fall to the ejection opening, the papers may be in disarray, or flipped over. Therefore, a problem exists in that when a user removes the papers from the ejection opening, they are not organized.

## 20 SUMMARY OF THE INVENTION

The present invention has been developed in view of the problem described above. It is an object of the present invention to provide a paper discharge unit which is capable of discharging papers so that they are arranged in position,  
25 even in the case that papers of different sizes are inserted thereinto. It is another object of the present invention to

provide a printing apparatus that employs the discharge unit.

The paper discharge unit of the present invention comprises:

5 a chute box having a plurality of slots for inserting papers of different sizes thereinto, provided at different heights in a first surface thereof;

a plurality of guide members, inclined downwardly from the plurality of slots, provided to form a gap through which the papers fall toward a second surface of the chute box facing  
10 the first surface in which the plurality of slots are formed; wherein

the chute box is provided with side walls for regulating widthwise movement on the guide member of a first paper, having the largest width among the papers; and

15 each of the guide members is provided with a guide rib for regulating widthwise movement of a second paper, which is smaller than the first paper, in cooperation with one of the side walls, the guide ribs extending from the slot to the second surface of the chute box.

20 The printing apparatus of the present invention comprises:

a plurality of printing engines capable of discharging papers of different sizes on which images are printed, the printing engines being housed in the printing apparatus in a  
25 stacked manner;

a chute box having a plurality of slots for inserting

papers of different sizes discharged by the printing engines thereinto, provided corresponding to each of the printing engines in a first surface thereof;

5 a plurality of guide members, inclined downwardly from the plurality of slots, provided to form a gap through which the papers fall toward a second surface of the chute box facing the first surface in which the plurality of slots are formed; wherein

10 the chute box is provided with side walls for regulating widthwise movement on the guide member of a first paper, having the largest width among the papers; and

15 each of the guide members is provided with a guide rib for regulating widthwise movement of a second paper, which is smaller than the first paper, in cooperation with one of the side walls, the guide ribs extending from the slot to the second surface of the chute box.

Note that the "guide ribs" may be provided so that the width between them and the one of the side walls becomes narrower toward the second surface of the chute box.

20 In addition, the "guide ribs" may be provided so that upper edges thereof approach the second surface of the chute box toward the end of the guide ribs away from the slots.

25 Downwardly extending sheet members may be provided at the distal ends of the guide members, the sheet members being in contact with the second surface of the chute box.

Further, the sheet member may be provided with a first

space for both edges in the width direction of the first paper to be inserted in, and a second space for both edges in the width direction of the second paper to be inserted in, in the case that the first and second papers are curled in the cross section  
5 of their width directions.

Still further, a paper housing portion for stacking and housing the papers may be provided below the chute box; and

a position controlling member for causing the papers which fall through the chute box to be stacked in the same  
10 direction may be provided between the chute box and the paper housing portion.

According to the paper discharge unit of the present invention and the printing apparatus using the same, when papers are inserted into the chute box and move therethrough while  
15 being guided, movement of the first paper, having the largest width, is regulated by the side walls of the chute box. Meanwhile, movement of the second paper is regulated by one of the side walls and the guide rib. Therefore, even in the case that papers of different sizes are inserted from the slots, the  
20 second paper does not rotate within the chute box. Accordingly, the first papers and the second papers are respectively discharged from the chute box at substantially uniform positions.

The guide ribs may be provided so that the width between  
25 them and the one of the side walls becomes narrower toward the second surface of the chute box. In this case, even if a

plurality of the second papers are inserted into the slots in a state that they are slightly shifted in the width directions thereof, they are caused to fall from substantially the same position.

5           The guide ribs may also be provided so that upper edges thereof approach the second surface of the chute box toward the end of the guide ribs away from the slots. In this case, the first papers which pass over the guide ribs can be positively be guided to the gap formed between the guide member and the  
10 second surface of the chute box.

          Downwardly extending sheet members may be provided at the distal ends of the guide members, the sheet members being in contact with the second surface of the chute box. In this case, the papers which fall through the gap are urged toward the second  
15 surface of the chute box. Therefore, the papers do not strike other guide members along their descent.

          Further, the sheet member may be provided with a first space for both edges in the width direction of the first paper to be inserted in, and a second space for both edges in the width  
20 direction of the second paper to be inserted in, in the case that the first and second papers are curled in the cross section of their width directions. In this case, rotation of the first papers and the second papers is prevented.

          Still further, a paper housing portion for stacking and  
25 housing the papers may be provided below the chute box; and a position controlling member for causing the papers

which fall through the chute box to be stacked in the same direction may be provided between the chute box and the paper housing portion. In this case, the papers which fall into the paper housing portion may be stacked in an arranged state.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a printing apparatus according to a preferred embodiment of the present invention.

Figure 2 is a view showing printing engines of the printing apparatus of Figure 1.

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Figure 3 is a sectional view of a paper discharge unit according to a preferred embodiment of the present invention.

Figure 4 is a front view of the paper discharge unit of Figure 3.

15 Figure 5 is a schematic view showing a gap of a guide member of the paper discharge unit of Figure 3.

Figure 6 is a schematic view showing sheet members provided in the gap of the paper discharge unit of Figure 3.

Figure 7 is a schematic view showing the periphery of a paper housing portion of the paper discharge unit of Figure 3.

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Figure 8 is a schematic view showing the manner in which papers fall from the guide members of the paper discharge unit of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

25 Hereinafter, an embodiment of the present invention will be described with reference to the attached drawings. Figure 1 is a perspective view of a printing apparatus 1. The printing

apparatus 1 is installed at a storefront, for example, to provide a printing service, wherein users print images represented by image data photographed by digital cameras, on a self-serve basis. The printing apparatus 1 comprises: a touch  
5 panel monitor 2; a media insertion slot 3; a print discharge opening 4; and a payment slot 5. When a user performs printing of images using the printing apparatus, he first inserts a recording medium into the media insertion slot 3. Then, the images recorded in the recording medium are displayed on the  
10 touch panel monitor 2. At this time, the user selects the images to be printed, sets print sizes of the images, sets the number of prints, and inserts money for a charge corresponding to the number of prints into the payment slot. Thereafter, the printing apparatus performs printing of the images, and papers  
15 on which the images have been printed are discharged from the print discharge opening 4.

The printing apparatus 1 is constructed so as to enable provision of a plurality of printing engines 10 therein, as shown in Figure 2. The printing engines 10 perform printing  
20 of images on papers. Four print engines 10, 11, 12, and 13 are provided in the printing apparatus 1 shown in Figure 2. The print engines 10, 11, 12, and 13 perform color printing on thermal recording paper by the thermo-autochrome method, for example. The printing engines 10, 11, 12, and 13 house papers  
25 corresponding to a plurality of print sizes (3x5, postcard size, CD size and the like) in the form of curled sheets. When the



user specifies a print size from among 4x6, 3x5, postcard size, CD size, and the like, each of the printing engines 10, 11, 12, and 13 perform printing of image data onto papers of the specified print size.

5           Figure 3 is a sectional view of a paper stacking portion 20 (paper discharge unit) employed by the printing apparatus of Figure 1. Figure 4 is a front view of the paper stacking portion 20. The paper stacking portion 20 of Figure 3 and Figure 4 is mounted on the paper discharge side of the printing engines 10, 11, 12, and 13. The paper stacking portion 20 comprises a chute box 30, a plurality of guide members 40, guide ribs 50, and a paper housing portion 70. The chute box 30 of Figure 3 is provided for papers OP discharged from the printing engines 10, 11, 12, and 13 to fall through to the paper housing portion 70. Slots 31 are formed for insertion of the papers OP into the chute box 30. The slots 31 are provided at a plurality of heights, corresponding to the paper ejection openings of the printing engines 10, 11, 12, and 13.

          The chute box 30 of Figure 4 comprises a hollow portion 32 for guiding the papers OP, which have been inserted through the slots 31, to the discharge opening 4. The width W of the hollow portion 32 is formed so as to allow a first paper OP1 having the largest size (e.g., 4x6), which is ejected from the printing engines 10, 11, 12, and 13 (inserted through the slots 31), to pass therethrough. Further, the width W is formed to be shorter than the diagonal length of the first paper OP1, so

that it does not rotate within the chute box 30. That is, the side walls of the chute box 30 restrict movement of the first paper OP1 in the widthwise direction thereof (the direction indicated by arrow X).

5           The guide members 40 are provided at the lower sides of each of the slots 31 of the chute box 30. One end 40a of the guide members 40 is positioned at the lower side of the slots 31, and the other end 40b is positioned toward a second surface 33 of the chute box 30, which faces the surface in which the  
10 slots 31 are formed. The guide members 40 are also inclined downward (the direction indicated by arrow Z1) from the slots 31.

Gaps 35 are formed between the ends 40b of the guide members 40 and the second surface 33. The papers OP which have  
15 slid off the guide members 40 fall downward (the direction indicated by the arrow Z1) through the gaps 35. Thereby, the papers which have been ejected from the printing engines 10, 11, 12, and 13 slide along the guide members 40 from the slots 31 toward the ends 40b, then fall through the gaps 35.

20           The guide ribs 50 are provided on the guide members 40. The guide ribs 50 serve to regulate movement of the papers OP on the guide members 40. The guide ribs 50 serve to regulate movement of a second paper OP2 having a smaller width (e.g., 3x5) than the first paper OP1, which is inserted through the  
25 slots 31 from the printing engines 10, 11, 12, and 13, in its widthwise direction (the direction indicated by the arrow X).

Specifically, the guide ribs 50 are provided at positions that allow the second paper OP2 to pass between them and a side wall 34b of the chute box 30, while preventing the second paper OP2 from rotating. Thereby, when the second paper OP2 is inserted  
5 from the slots 31, movement in the widthwise direction thereof is regulated by the guide ribs 50, in cooperation with the side wall 34b.

Here, the guide ribs 50 are provided so that the widths between them and the side wall 34b narrows toward the second  
10 surface 33 of the chute box 30 from the ends 40a (at the side of the slots 31) of the guide members 40. Therefore, even in the case that the second paper OP2 is inserted from the slots 31 shifted in the direction of the arrow X, or inclined with respect to the direction indicated by arrow X, the second paper  
15 OP2 is guided while its widthwise movement is regulated, and caused to fall through the gap 35 at substantially the same position. Note that in the case that a plurality of first papers OP1 are shifted in their widthwise directions (the direction indicated by the arrow X) when inserted through the slots 31,  
20 they are caused to fall in an aligned state by side walls 34a and 34b.

Further, upper edges 50a of the guide ribs 50 are provided to approach the second surface 33 of the chute box 30 toward the ends 40b of the guide members 40. As shown in Figure 5,  
25 which is a bottom plan view of the gap 35, the upper edges 50a contact the curled first sheet OP1, to regulate rotation

thereof.

Elastic sheet members 60, formed of plastic film or the like, are attached to the ends 40b of the guide members 40. The sheet members 60 are attached to the ends 40b of the guide members 5 40, and extend downward (the direction indicated by the arrow Z1) into the gap 35. The sheet members 60 are in contact with the second surface 33 of the chute box 30, and the papers OP fall between the sheet members 60 and the second surface 33. At this time, the sheet members 60 apply force to the papers 10 OP in the direction that presses them toward the second surface 33 (the direction indicated by arrow Y2). This force prevents the papers OP from getting stuck on the other guide members 40 along their descent, thereby preventing paper jams.

As shown in Figure 6, the sheet members 60 have first 15 spaces 61 for accommodating both widthwise edges of the first sheets OP1; and second spaces 62 for accommodating both widthwise edges of the second sheets OP2. Thereby, the curled first papers OP1 and the curled second papers OP2 fall along the sheet members 60 in a state in which both edges thereof are 20 accommodated within the first spaces 61 and the second spaces 62. Therefore, rotation of the first papers OP1 and the second papers OP2 during their descents is prevented.

As shown in Figure 7, the paper housing portion 70 is placed beneath the chute box 30. The paper housing portion 70 25 stacks and houses the papers OP which have fallen through the chute box 30. A housing surface 71 is inclined with respect

to the X-Y plane. A substantially flat surface 72 is provided on the downstream side of the housing surface 71. The edges of the papers OP, which fall from the chute box 30, strike the housing surface 71, move toward the downstream side thereof, and the edges are aligned by the flat surface 72. Meanwhile, the papers OP fall in a state in which movement in the widthwise directions (the direction indicated by the arrow X) thereof is restricted by the side walls 34a, 34b, and the guide ribs 50. Therefore, the papers OP fall at substantially the same positions in the X direction (refer to Figure 4). Accordingly, when the papers OP are stacked, their edges are aligned.

A position controlling member 80 is mounted beneath the chute box 30, on the upper part of the paper housing portion 70. The position controlling member 80 comprises a position controlling sheet 81 and the lowest guide member 41. The lowest guide member 41 is provided to extend from the slot 31 so that a portion of the second surface 33 is positioned above the gap 35. The position controlling sheet 81 is attached to the lowermost portion of the chute box 30, and extends downward so as to contact the surface of the lowest guide member 41. The edges of the papers OP which have fallen through the gap 35 strike the lowest guide member 41, and the papers OP are caused to be laid in the Y direction. At this time, the position controlling sheet 81 aids in the laying of the papers OP by applying a force thereon in the direction toward the slots 31 (the direction indicated by arrow Y1). Thereafter, the papers OP move toward

the downstream side of the lowest guide member 41, and fall into the paper housing portion 70.

That is, the papers OP fall in the direction indicated by the arrow Z, oriented in an erect position by the guide members 40 and the sheet members 60. If the papers OP fall into the paper housing portion 70 in this state, shock will be applied to the papers OP already stacked therein, possibly causing damage thereto. At this time, by the position controlling member 80 laying the papers OP down from their erect positions, the shock applied to the papers OP which are already stacked within the paper housing portion 70 is reduced. Thereby, damage to the papers OP is prevented.

Figure 8 is a schematic diagram showing the movement of the paper OP from the slots 31 to the gap 35. An example of the operation of the paper stacking portion 20 will be described with reference to Figure 1 through Figure 8. First, papers OP ejected from the printing engines 10, 11, 12, and 13 are inserted into the chute box 30 through the slots 31. Then, the papers OP are guided by the guide members 40 to slide into the gap 35. At this time, the first papers OP1 are regulated in their widthwise movement by the side walls 34a and 34b of the chute box 30. Meanwhile, the second papers OP2 are regulated in their widthwise movement by the guide ribs 50 and the side wall 34b. All of the first papers OP1, having been guided by the side walls 34a and 34b, fall from substantially the same position of the gap 35. All of the second papers OP2, having been guided by

the side wall 34b and the guide ribs 50, fall from substantially the same position of the gap 35, after sliding along the inclined guide members 40.

Thereafter, the papers OP which fall through the gap 35  
5 descend while being pressed against the second surface 33 by the sheet members 60. Further, the first papers OP1 and the second papers OP2 fall while being restricted from rotating by the first spaces 61 and the second spaces 62, respectively.

Then, when the papers OP have fallen to the lowermost  
10 portion of the chute box 30, the papers OP fall into the paper housing portion 70 in a state in which they are laid down in the Y direction. The edges of the papers OP are aligned by the flat surface 72, and the papers OP are stacked.

According to the embodiment described above, when papers  
15 OP are inserted into the chute box 30 and move therethrough while being guided by the guide members 40, movement of the first paper OP1, having the largest width, is regulated by the side walls 34a and 34b of the chute box 30. Meanwhile, widthwise movement of the second paper OP2 is regulated by the side wall 34b and  
20 the guide ribs 50. Therefore, even in the case that papers OP of different sizes are inserted from the slots 31, the second paper OP2 does not rotate within the chute box. Accordingly, the first papers OP1 and the second papers OP2 are respectively discharged from the chute box 30 at substantially uniform  
25 positions.

The guide ribs 50 are provided so that the width between

them and the side wall 34b becomes narrower toward the second surface 33 of the chute box 30. Therefore, even if a plurality of the second papers OP2 are inserted into the slots 31 in a state that they are slightly shifted in the width directions thereof, they are caused to fall from substantially the same position.

The guide ribs 50 are also provided so that the upper edges 50a thereof approach the second surface 33 of the chute box 30 toward the end of the guide ribs 50 away from the slots 31. Therefore, the first papers OP1 which pass over the guide ribs 50 can be positively be guided to the gap 35 formed between the guide members 40 and the second surface 33 of the chute box 30.

Downwardly extending sheet members 60 are provided at the distal ends of the guide members 40, the sheet members 60 being in contact with the second surface 33 of the chute box 30. Therefore, the papers OP which fall through the gap 35 are urged toward the second surface 33 of the chute box 30. Accordingly, the papers OP do not strike other guide members 40 along their descent.

Further, the sheet members 60 are provided with the first spaces 61 for both edges in the width direction of the first paper OP1 to be inserted in, and the second spaces 62 for both edges in the width direction of the second paper OP2 to be inserted in, in the case that the first and second papers are curled in the cross section of their width directions. Therefore, rotation of the first papers OP1 and the second



papers OP2 is prevented.

Still further, the position controlling member 80 for causing the papers OP which fall through the chute box 30 to be stacked in the same direction is provided between the chute  
5 box 30 and the paper housing portion 70. Therefore, the papers OP which fall into the paper housing portion 70 are stacked in an arranged state.

The present invention is not limited to the embodiment described above. For example, guide ribs 50 for guiding papers  
10 OP of the 3x5 size are provided on the guide members 40. However, guide ribs 50 may be provided for guiding papers OP of the postcard size or the CD size. In addition, a single guide rib 50 for guiding the papers OP of the 3x5 size is provided on each guide member 40. However, a plurality of guide ribs 50, for  
15 guiding papers OP of the 3x5 size, the postcard size, and the CD size, respectively, may be provided on each guide member 40.

In this case, in the same manner that the guide ribs 50 do not interfere with the movement of the curled first papers OP1, the guide ribs for the papers OP of the postcard size and  
20 the guide ribs for the papers OP of the CD size do not interfere with the curled papers OP of the 3x5 size. Movement of the postcard size papers OP and the CD size papers OP on the guide member 40 is also restricted. Therefore, rotation of all of the papers OP on the guide members 40 is prevented.